

directing one's attention to the peculiar conditions often presented in the lower animals by the multiplication and metamorphosis of individuals. Although I have sought carefully in the group to which I have just been referring for alternations between a sexual and an agamic generation, I have never met with it. The number of zoanthodemata is only increased sexually. Blastogenesis or gemmation extends the zoanthodemata or colonies by multiplying the number of inhabitants in each of them; but these budded individuals are soon sexual, resemble those from which they are derived, and assist in reproduction by fecundation, without presenting any peculiarity except their origin.

It is constantly the case in the whole of this group that fecundation takes place in the general cavity of the body of the female, or even in the ovary, and that the female hatches her ova after impregnation; thus she does not produce eggs, but, by a true parturition, rejects by the mouth ciliated vermiform embryos or larvæ, which attach themselves after having for a short time enjoyed complete freedom.

L.—*Observations on Raphides and other Crystals in Plants.*

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[Continued from p. 382.]

*Dictyogenæ.*—At the end of the last communication, the deficiency of raphides in the Cryptogameæ Ductulosæ was noticed, as well as in Potamogetonaceæ, Naiadaceæ, Cyperaceæ, and Gramineæ, which four orders conclude the class Monocotyledones in the 'Manual of British Botany;' and I had before shown how raphides constantly abound in the subdivision Dictyogenæ, therein placed at the beginning of this class.

Now the orders Coniferæ and Hydrocharidaceæ, between which is the position of Dictyogenæ in the lineal series of the natural arrangement of that book, are as regularly devoid of raphides. Extending the inquiry from the flora of Britain to that of the world, the facts, as far as my observations have yet gone, are to the same effect. Thus the fifth class in Prof. Lindley's 'Vegetable Kingdom' is formed by the Dictyogens, and placed lineally between his Alismal Alliance and Gymnogens. But in no order of these last two groups have I yet found raphides, though I have searched some of the exotic as well as all but one of the indigenous species; while every plant belonging to the Dictyogens, either native or foreign, that has ever come under my examination was constantly found abounding in raphides.

Hence, besides the diagnostics already described by systematic

botanists, it must now be admitted that the British Dictyogens also truly and naturally differ, in the possession of this character of raphis-bearing, from their nearest neighbours of other orders. And the same character has been found in every exotic species of the class hitherto examined by me in this respect.

The names of the plants thus examined have been specified in preceding parts of these Observations. And since the present paper was in type, Mr. W. H. Baxter, the botanist to whom I have so often been indebted for generous assistance in these inquiries, has sent me fragments of leaves of three Dictyogens, of which notes of my examinations here follow:—*Dioscorea discolor*: raphides swarming. *Philesia buxifolia*: raphides much less abundant, but yet rather numerous. *Roxburghia gloriosoides*: true raphides very scanty; but a profusion of crystal prisms lying singly between and parallel with the transverse veins of the leaf.

*Araceæ*.—In the last communication, it should have been noticed that I have found, as was expected, an abundance of raphides in *Pistia stratiotes*; they occur with a plentiful crop of sphæraphides in this plant, and the cells of both are very distinct.

*Nyctaginaceæ*.—Besides the plants mentioned in the ‘Annals’ for last October, I have recently, through the courtesy of Mr. W. H. Baxter, had an opportunity of examining fragments of several dried specimens of this order. Of these the following are notes:—*Boerhaavia paniculata* [leaves, twig, and flower-buds]: abounding in raphides. *Collignonia scandens* [leaf and flower]: raphides small and very scanty, with some bits of larger crystal prisms. *Neea obovata* [leaf and flower]: many raphides and larger crystal prisms. *Pisonia aculeata* [leaf, flower, and twig]: raphides abundant in the flower and twig, and, with many crystal prisms besides, in the leaf. *Tricycla spinosa* [stalk, leaf, bracts, and fruit]: raphides swarming in all these parts, and some in the corolla and seed-skin. *Okenia hypogæa* [twig and leaf]: raphides abundant. Add to these, cultivated plants of *Abronia*, in the leaves and seed-leaves of which, as well as in the persistent calyx of the fruit, I have constantly found numerous raphides.

Taking the orders Plantaginaceæ, Nyctaginaceæ, and Amaranthaceæ as they stand lineally in Prof. Balfour’s ‘Manual of Botany,’ the central and exotic order differs (like three orders of our native Dicotyledones; ‘Annals,’ July 1864), in the possession of this character of raphis-bearing, from its next neighbouring orders. And so, too, regarding the recognized affinity of Nyctaginaceæ with Chenopodiaceæ, the result is still similar; for, although I have often shown how abundant sphæraphides are in this last order, I have not seen true raphides in it; nor have I and Polygonaceæ a raphis-bearing order.

In short, while every plant that I have examined of the order Nyctaginaceæ constantly afforded raphides, all the plants examined of its neighbouring orders just mentioned were as regularly found to be devoid of raphides.

It is also noteworthy how we now see the trees and shrubs of this exotic order (Nyctaginaceæ) abounding in raphides—a fact of which no parallel has yet appeared to me in our native flora; indeed I do not recollect a single example of true raphides in any British tree or shrub, excepting *Ruscus*, a small shrubby liliaceous plant ('Annals,' July 1864).

*Ficoidales*.—In this alliance Prof. Lindley includes the orders Basellaceæ, Mesembryaceæ, Tetragoniaceæ, and Scleranthaceæ. True raphides swarmed in every species examined by me of *Mesembryanthemum* ('Annals,' Oct. 1864); and a late repetition of many of those observations, with additional examinations of at least eleven species (being all I could collect), have afforded the same result. But I have never yet found raphides in any other plant belonging to the Ficoidal Alliance, after having searched for them in more than one species of each of the other three orders. And when we took the orders Crassulaceæ, Ficoideæ, and Cactaceæ as they occur successively in Prof. Balfour's 'Manual,' the result was similar—*Mesembryanthemum* still isolated, as a great raphis-bearing group, from those neighbouring orders ('Annals,' May 1864). Of Basellaceæ and Tetragoniaceæ, besides the plants specified in former communications, I have lately searched in vain for raphides in dried fragments of three species of *Trianthema*, one of *Anredera*, and in the fresh leaves and root-stock of *Basella tuberosa*—all plants affording sphaeraphides, like those of Chenopodiaceæ. Finally, again by the kind aid of Mr. W. H. Baxter I have examined dried portions of *Glinus Mollugo*, *G. lotoides*, and *Lewisia rediviva*, in neither of which could any raphides be found.

Here, then, as far as these observations have yet extended, is this vast genus *Mesembryanthemum* distinguished as a raphis-bearing group from all its allies—a difference so remarkable and natural as to make it very desirable that every one of these plants should be examined in this respect by those botanists who may have the means of extending and correcting the present results. And it should be recollected that the sphaeraphides which I have found so abundantly in Tetragoniaceæ are not to be confounded with raphides, but are so like the sphaeraphides of Chenopodiaceæ as to make a curious resemblance in this respect between these two orders, in addition to the affinity already noticed between them by Prof. Lindley.

Edenbridge, May 15, 1865.

[To be continued.]